



Fig. 2.—Internal hernia with complete intestinal obstruction caused by migration of jejunum through opening made between stomach, ligament of Treitz and jejunum.

where in which an acute intra-abdominal attack followed a Polya resection. In the latter instance, as proved at autopsy, there was a strangulation of the jejunum and ileum caused by the migration of the small intestine through the artificial aperture between the stomach, ligament of Treitz, and mesocolon. Because of the great similarity of the two cases, we made the same diagnosis on this patient and recommended immediate laparotomy.

At operation it was found that no adhesions existed between the former operative scar and the viscera. The mass in the left upper quadrant consisted of edematous loops of jejunum and ileum which had become strangulated following migration through the artificial aperture, always resultant upon gastro-enterostomy, the boundaries being the ligament of Treitz, the mesocolon, the stomach and the anastomosis. The loops were easily pulled back through the stoma and replaced in their normal position. No injury was done



Fig. 3.—Repair of opening left after gastro-entero-anastomosis.

to the anastomosis. Four interrupted chromic catgut sutures were then used to close the opening. The patient made an uneventful recovery and has remained well.

COMMENT

We feel that, by adding to the literature the record of this unusual complication, emphasis is placed on two important factors: first, prevention of such an occurrence; second, the fact that this complication should be constantly in mind when an acute intestinal obstruction occurs at any time following a gastro-enterostomy. In such a case delay for diagnostic procedures may result in alkalosis, hemorrhage, rupture of the suture line or edema, with death of portions of the intestines. Delay in reduction of the strangulation may entail a prolonged and serious operation in which the anastomosis must be torn down, the loops disengaged, and the anastomosis rebuilt.

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THE SPECIFIC GRAVITY OF THE BLOOD

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ALTHOUGH the specific gravity of the blood under varying conditions in the past has proved of little clinical value, it was used as an index to the hemoglobin percentage for years before the advent of the present methods. Tables were devised with corresponding values, which were inaccurate, however, due to failure to consider the effect of the color index.

Rogers¹ made use of it to determine the degree of blood concentration during the evacuation stage of cholera in the London epidemic of 1908 and the use of intravenous saline was predicated upon this factor. It was found that extreme dehydration raised the specific gravity to 1066 instead of a normal 1058 and indicated the necessity of intravenous saline. Recently Barbour and Hamilton² have reported a falling drop method for determining this factor and believe that it should be investigated again in various conditions.

Forty years ago, when venesection was common, actual weight of the blood was possible. The direct method, comparing the weight of the blood with an equal amount of distilled water, using the pycnometer, was feasible. This still

remains the most accurate, though obviously impractical.

Anemia, polycythemia, either true or relative, due to concentration by diarrhea, prolonged vomiting or sweating, the hydremic plethora following hemorrhage, should change the specific gravity.

Qualitative changes in plasma, such as the azotemia of nephritis and the hyperglycemia of diabetes presumably should alter it.

The present report includes the results of fifty determinations done upon whole blood by the Hammerschlag method.

TECHNIQUE

This method consists of suspending a drop of blood in a mixture of benzine and chloroform and carefully varying the concentration of each until the drop remains poised midway between the top and bottom. The specific gravity of that mixture, determined by the hydrometer, is then equivalent to that of the blood. Baumann³ checked this method by the actual weight of the blood by the pycnometer in a number of experiments on dogs and concluded that it was a method "clinically easily applied and yielded, both in health and disease, results that were uniform and reliable," although the results are proportionately slightly higher than pycnometer determinations.

BASIS FOR PRESENT REPORT

In the studies reported here, determinations were made on the blood of fifty people, nine of whom were apparently in good health and the others suffering from varying conditions. Particularly the effect of conditions producing concentration of the blood from anhydremia, such as vomiting and diarrhea, was observed. A number of severe anemias were included in the study. It was hoped to discover some relation whereby the blood count of patients truly anemic, but concentrated by dehydration, might be determined accurately.

A blood count of five million in an originally anemic patient who has been vomiting persistently is of no value as an accurate count.

Two erythrocytic counts were done on each patient with pipettes certified as correct by the

United States Bureau of Standards, and an average taken. The hemoglobin determinations were done with a Sahli hemoglobinometer. The specific gravity readings varied from 1030 in a patient who had pernicious anemia to 1064 in one with a generalized peritonitis who had been vomiting for twelve hours. The latter was obviously dehydrated with dry, wrinkled skin, the former showed the well-preserved physique seen often in pernicious anemia. Determinations were made on several normal individuals at varying times of the day and the same figure obtained, contrary to the idea that diurnal variations were appreciable.

In the group of individuals that were considered normal the results ranged from 1049 with a red count of 4.49 millions and 90 per cent hemoglobin, to 1058 with a red count of 4.8 millions and 90 per cent hemoglobin. In seven instances of pernicious anemia the results ranged from 1030 in a patient with 1.1 million red cells to 1036 in a patient with two million red cells. The remainder of the patients were of widely diverse conditions, including heat exhaustion, filariasis, diabetes with high blood sugar and nephritis with high blood urea.

In a patient with strangulated umbilical hernia who vomited for three days there was a red cell count of 6.2 million, 104 per cent hemoglobin and a specific gravity reading of 1061. Another with peritonitis after twelve hours vomiting had 6.9 million red cells and a reading of 1064 for specific gravity.

There apparently was a very definite relation between the specific gravity of the blood and the quantity of hemoglobin present. With the color index, one, a reading of 1030 corresponded approximately with a count of 1,000,000 and a rise in red cells of 500,000 was accompanied by a corresponding rise of three points in the specific gravity. It was possible to predict very closely the red cell count by the specific gravity reading save in severe secondary anemia with marked disturbance of the color index.

Copeman⁴ studied one patient who had a red cell count of 500,000 and a specific gravity reading of 1027. Blood serum specific gravity is approximately 1027. Those patients with a red

TABLE 1.—Ten Cases Showing Relation of Specific Gravity to Hemoglobin and Red Cell Count

Specific Gravity	Hemoglobin	Red Blood Cells	Color Index	Diagnosis
1. 1030	22	1,175,000	1.14	Pernicious anemia
2. 1030	24	1,180,000	1.1	Pernicious anemia
3. 1036	42	2,010,000	1.1	Pernicious anemia
4. 1045	71	3,600,000	.9	Secondary anemia
5. 1048.5	70	3,995,000	.9	Nephritis—blood urea 76
6. 1051	95	4,490,000	1.0	Normal
7. 1055	85	5,225,000	.8	Diabetes—blood sugar 190
8. 1057	95	5,650,000	.9	Arthritis deformans
9. 1060	104	6,170,000	.88	Asthmatic bronchitis
10. 1064	104	6,900,000	.9	Peritonitis—vomited for 12 hours

cell count higher than would be expected from the specific gravity reading were found to have a low color index. Conversely, those showing red cell counts lower than would be expected from the specific gravity reading were found to have a high color index. Thus, in one instance a specific gravity reading of 1030 was found in a patient with a red cell count of 730,000 and a hemoglobin of 25 per cent or a color index of 1.6. With a color index of 1 the red cell count here would be 1,168,000, which corresponds to the specific gravity reading of 1030.

Despite the variety of conditions studied, representing diabetes with high blood sugar, nephritis with nitrogen retention, and other metabolic disturbances, there were no significant variations in the specific gravity save those due to variation in the quantity of hemoglobin. Apparently the factor overshadowing all others in changes in specific gravity is the hemoglobin content, the constituents of the plasma exerting little influence.

CONCLUSION

The determination of the specific gravity of the blood is apparently of little practical clinical value and its addition to the ever-increasing list of laboratory procedures seems unnecessary.

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SURGICAL TREATMENT OF STAPHYLOCOCCUS MENINGITIS

REPORT OF CASE

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LM., Los Banos, June 24, 1929. White, single, schoolboy, sixteen years of age. Referred by Doctor Mott.

Family History.—Grandfather died of tuberculosis at about forty years of age. Otherwise, family history good.

Past History.—Patient was born in New York. Came to California at the age of eight years. Had whooping-cough at the age of five years; measles at the age of seven years. Had his tonsils removed in 1925. Was operated on for appendicitis in 1926 and at the same time had a right inguinal hernia repaired. In 1928 he had severe attack of scarlet fever and was sick about three weeks, but fully recovered, apparently without complications or sequela.

Present History.—About June 10, 1929, he developed a small carbuncle on the back of the neck on left side near hair line. After a few days it was incised and drained. Six days later he developed severe pain in hip and calf of left leg with some fever. The following day he was brought to Fresno and had x-rays taken of the hip and leg, with apparent negative find-

ings. However, the back was strapped with adhesive plaster with no apparent relief. On June 24 he was admitted to the Union Hospital, at which time patient had a temperature of 104 degrees. The same evening he developed definite symptoms of spinal meningitis, and the following day I was called to perform a spinal puncture.

Physical Examination.—On inspection I found his general appearance very characteristic. He was a well-nourished young man, about five feet six inches tall, and weighing about 130 pounds. Lying straight in bed on his back with head drawn backward; with flushed cheeks and an anxious expression. His shoulders were drawn upward and his neck and back muscles were rigid. His respiration was somewhat labored. Pulse was 106, good quality. Temperature was 102.6 degrees. His abdomen was distended with gas. Upon auscultation his heart and lungs were negative. His lower extremities were extended, rigid, with heels drawn upward from tonic contraction of gastrocnemius and soleus muscles, causing his toes to point almost in line with the legs. He complained of severe pains in hips and legs, especially on manipulation.

Treatment.—The spinal needle was inserted between the first and second lumbar vertebra, and after considerable difficulty in getting the fluid through the needle, was successful in removing fifty cubic centimeters of thick, yellowish pus. At the same time injected antimeningococcus serum. The patient was immediately relieved and remained so for about two hours, after which his condition returned as before. The culture and microscopic examination of pus revealed *Staphylococcus aureus* in pure culture. Six hours later another puncture was made and about twenty cubic centimeters of pus removed. This time the canal was washed with antistreptococcus serum. Upon getting the laboratory report of staphylococcus infection, I suggested operative measures in hopes of establishing a permanent drainage. On June 26 the condition was progressively getting worse. Respiration was labored and marked cyanosis present. The upper and lower extremities were completely paralyzed except his hands and fingers, in which he had slight voluntary movement. Three punctures were made in the twelve hours. The last puncture, the needle was left in the spine with hopes of draining the pus and keeping down pressure, but very little drainage was accomplished on account of pus drying in the lumen of the needle and stopping the flow. Three hours later the needle was removed.

Treatment Continued.—On June 27, after a series of consultations, an operation was performed under ethylene anesthetic. A laminectomy of the second lumbar vertebra was done. Upon opening meninges, a large amount of pus drained into incision. The condition of patient was very bad, so a rapid closing was necessary and a small rubber drainage tube, surrounded by gauze, was inserted. Oxygen and stimulants were given: adrenalin, strychnin, etc. His temperature at 12 o'clock noon was 105 degrees. At 1 p. m. he was taken to surgery, and about 2 p. m. his temperature was 107 degrees. By 3 p. m. it dropped to 104 and by 12 o'clock midnight it was 98.6 degrees. At 4 a. m. it again returned to 104.6 and thereafter it ranged from 99 to 103. Nothing of much interest developed for about ten days except that his breathing steadily improved. About the middle of the second week he was able to move his arms. After the third week he could use his legs somewhat, and from then on the paralytic condition improved daily. On August 7 (which was six weeks and two days from the time he entered the hospital) he was discharged from the hospital with still a slight drainage from the wound.

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